

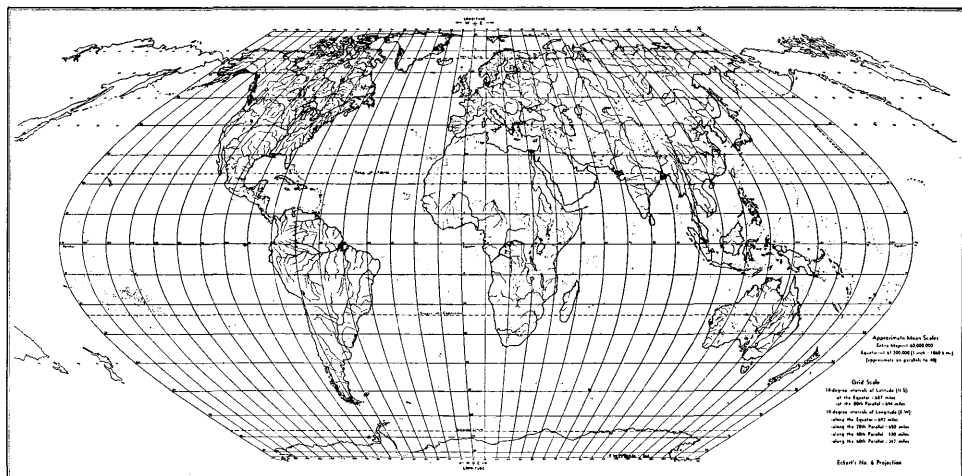
A MAP OF THE WORLD IN PERSPECTIVE¹

A NEW ATTEMPT TO IMPROVE WORLD AREAL PLOTTINGS, BASED UPON ECKERT'S NO. 6 PROJECTION²

F. WEBSTER MCBRYDE

Department of Geography, The Ohio State University

In representing the earth's spherical surface upon a plane, any map projection must inevitably involve some distortion, which increases with the size of the area included. A world projection, developing the grid of the entire earth, therefore, presents maximum difficulty in overcoming distortions. The principal properties which may be preserved on the map, as they are on the earth, may be listed as follows: (1) equivalence, or true relative sizes of areas; (2) conformality or true angles formed by intersecting lines (compass directions, if grid lines are straight, as on the Mercator projection); (3) true shapes of areas; (4) equidistance, or true scale, along certain lines; (5) continuity of surface, with the grid unbroken.



Preservation of all of these at once is possible only on the globe. On a flat surface one or several of the properties may be kept, but there is always a sacrifice. Evaluation of a projection for any purpose thus involves a balancing of the gain with the loss. Some projections which develop special traits lose all of the above properties. This is a high price, but it may be worth it, as is the case with the invaluable gnomonic projection, on which a great-circle route is easily determined from a straight line. The Mercator map preserves true compass bearings throughout, and so is indispensable for correctly plotting any directional data. Yet neither of these navigation charts should be employed for any use where areal relationships

¹The figurative rather than literal interpretation of this word is intended, for obviously the entire earth surface cannot be shown in true perspective. The orthographic hemispherical projection is the only true perspective representation.

²For a summary and illustrations of Eckert's series of six projections, cf. Max Eckert, "Neue Entwürfe für Erdkarten," Petermanns *Mitteilungen*, Vol. 52, pp. 97-109, 1906. The writer is indebted to Mr. John B. Leighly, University of California, for first calling attention to Eckert's projections, and for providing the necessary grid data.

are desired, since sizes, shapes, and scales are badly distorted away from the tangency. Nevertheless, the Mercator projection is today probably the most widely employed base for world plottings which depict areas and distributions. This despite the years of effort on the part of geographers to supplant it with equivalent projections.

These attempts may have failed because of an over-emphasis upon the value of shape. The map herewith presented³ was produced on this premise, and represents a new approach towards the establishment of a suitable equivalent map, desirable now as never before in view of unprecedented interests in world areas. It is assumed, then, that the major properties listed above may be arranged as follows in descending order of importance upon a world areal map: (1) true sizes of areas, (2) continuity of grid, (3) true bearings of grid lines, (4) true shapes of areas, (5) true scale. It is impossible to preserve either of the last two, namely, true shapes and scales, on all parts of any world map. And only the Mercator projection shows true bearings throughout.

An appraisal of the "perspective" map, illustrated in this paper, may be made in terms of these five properties. First of all, it is equivalent, with no size distortions. Secondly, it is plotted on an unbroken grid. There is less attempt to preserve true continental shapes, as is often approached on world maps at the expense of the ocean areas,⁴ than to maintain continuity of continents, not only upon the grid, by centering the meridian of 10° east longitude in order to split the Pacific through the Bering Strait and thus keep the continents entire, but also beyond the grid by lateral extensions which repeat northwestern North America and northeastern Eurasia so as to bring out the essential relationships of the lands bordering the North Pacific.⁵ As to the third point, east and west are true directions, since the parallels are straight. This keeps the important factor of latitude on a comparative basis, as is not the case where parallels are curved. Though there is inevitably a deviation from true north and south, since meridians are curved, it is not nearly so great as on the more compressed elliptical projections, such as the Homolographic. For this latter reason, the fourth property, namely shape, is less subject to distortion than on the elliptical and "semi-elliptical" projections, though they may not even preserve equivalence. That shapes of marginal areas are distorted on Eckert's No. 6, cannot be denied, yet this does not seem to be too high a price to pay for the areal relationships which it brings out. The sine curves, from which the term "semi-sinusoidal" may be applied to the projection, maintain the high-latitude grid spaces more open than is possible with elliptical meridians. Finally, scale, though exactly true only along the equator, is closely approximated along all grid lines out to the fortieth parallels. By stating scale in terms of miles between grid intervals rather than miles to the inch, errors are avoided even in high latitudes. A further advantage of this type of projection is the manner in which it suggests the spherical form of the earth, maintaining something of the true position of the "down-under" lands of the southern hemisphere, such as Australia. This is lost on the Mercator and on most of the interrupted projections.

³Published in outline as "McBryde's Perspective Equal-Area Base-Map," College Book Co., Columbus, Ohio.

⁴The "interrupted" projections, e. g., give a false appearance of exaggerated width to the Atlantic, and the "jig-saw puzzle" maps cut out the oceans and fit the continents snugly together in wholly misleading juxtaposition.

⁵Such lateral repetition is not practicable on projections where meridians are ellipses, and on the cylindrical projections, such as Mercator's, it may be done only at the expense of considerable space, for the entire set of meridians must be repeated. Thus, the "semi-sinusoidal" projection is the only one on which the extensions may be satisfactorily fitted into unoccupied corners of the map off the grid.